

# Chapter 4

## Current Research on Prospective Secondary Mathematics Teachers' Professional Identity

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### 1 Introduction

Identity is a construct widely investigated in a number of research fields and has a variety of interpretations. It is a relevant area of study within mathematics teacher education research (Skott et al. 2013), and several researchers have used it as a theoretical lens (Brown and McNamara 2011; Gama and Fiorentini 2008; Oliveira 2004; Ponte and Chapman 2008; Pamplona and Carvalho 2009; Walshaw 2004, 2010). In this survey we analyzed research studies related to the professional identities of prospective secondary mathematics teachers (PSMTs).

According to Sachs (2005), “teacher professional identity stands at the core of the teaching profession. It provides a framework for teachers to construct their own ideas of ‘how to be’, ‘how to act’ and ‘how to understand’ their work and their place in society” (p. 15). Teacher professional identity is a complex notion since it addresses the complex and mutual relationships between the teachers, the institutions where they work, and the societies where they live. In this way, professional identity is a notion that gathers together personal and social aspects, encompassing knowledge and beliefs, emotions and relationships, and context and experiences (Van Putten et al. 2014). Professional identities are developed collectively with others, in the interactions a teacher has with school principals, colleagues, students, parents, etc. Although professional identity involves what others think or say about a person, it also involves how a person sees herself, her capacity to reflect upon her experiences, and her capacity to act upon the world for creating new ways of being.

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In this way, professional identity development is also intrinsically related to the development of agency.

Therefore, the PSMTs' identity development is a complex process that includes the personal, professional, intellectual, moral, and political dimensions of prospective teachers and the groups in which they are involved (Beijaard et al. 2004; Day et al. 2005; Kelchtermans 2009; Lasky 2005; Oliveira and Cyrino 2011). The future oriented dimension of professional identities is especially important for PSMT's education. As Beijaard et al. (2004) pointed out, professional identities are not "only an answer to the question 'Who am I at this moment?', but also an answer to the question, 'Who do I want to become?'" (p. 122). Thus, analyzing how PSMTs construct their identities in the spaces and moments offered and promoted by pre-service education is an important issue.

## 2 Methodology of the Survey

In agreement with other members of the survey topic group, the authors sought studies related to PSMTs' professional identity that were published in the nine international research journals in mathematics education and two relevant Latin-American journals.<sup>1</sup> The researchers felt that including the two Latin-American journals in the search would enable them to capture research that has been conducted by mathematics educators from non-English-speaking countries.

The review of the literature was restricted to the period from 2005 to 2015.<sup>2</sup> Several searches were conducted using combinations of the key words "prospective teachers" and "secondary" with the following key words related to professional identity: "identity", "self", and "agency". For each search result, the article's title and abstract were read. If the study was connected to professional identity, then it was selected. Several studies were excluded that addressed the notion of identity, but were focused on students, prospective elementary mathematics teachers, in service mathematics teachers, or mathematics educators. Consequently, some of the targeted journals did not include studies, which met our criteria. This search resulted in the selection of 14 articles.

Next, the articles were read and analyzed with respect to their (1) focus, (2) theoretical perspective, (3) methodology, and (4) findings. The analysis of the articles led to a division of the studies into two groups. Group 1 is comprised of four articles, which do not address professional identity directly, but they focus on important related notions. These notions are *field/habitus and dispositions* (Nolan

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<sup>1</sup>*Bolema* (Boletim de Educação Matemática—Mathematics Education Bulletin) edited by the São Paulo University (UNESP) and *Relime* (Revista Latinoamericana de Matemática Educativa—Latin-American Journal of Mathematics Education) edited by the Latin-American Committee of Mathematics Education.

<sup>2</sup>It is important to highlight that the survey was carried out in November, 2015. In this way, the last volumes of the year 2015 were not considered.

2012), *beliefs about the teacher's role* (Lloyd 2005), *narrative writing* (Gonçalves and De Carvalho 2014), and *emotionality* (Boylan 2010).

Group 2 is comprised of 10 studies in which professional identity is the main focus of the research. In each of these studies, the notion of identity is mentioned in at least one of the research questions or is the main aim of the research. In addition, these studies conceptualize, in diverse ways and degrees, the notion of identity and present findings related to PSMTs' professional identity. The review shows that the number of studies focused on PSMTs' professional identity is growing over time which made it possible to find studies in the selected journals from the period of 2005–2015. *JMTE* and *ESM* are the journals which have published most of the research reports focused on this topic during the period considered. The ten articles were separated into three sub-groups based mainly on their research focus: (a) studies that addressed the relationships between PSMTs' identities and field experiences during pre-service education, (b) studies centered on the linkages between PSMTs' identities and the learning of specific mathematical topics, and (c) studies that investigated the ways in which PSMTs represented their professional identity. In the following section, we describe each sub-group by summarizing the articles that compose them.

### 3 The Selected Studies: What Has Been Studied in the Area?

#### 3.1 *Professional Identity and Field Experiences*

Four studies addressed the relationships between the development of a professional identity and field experiences during prospective secondary mathematics teacher education programs. Goos (2005) analyzed the personal and contextual factors that influenced the development of PSMTs' pedagogical identities. This study considers the transition from pre-service education to beginning teaching of secondary school mathematics and investigates PSMTs' experiences during practicum and during their first year of serving as mathematics teachers in schools. Particularly, the author focused on the part of the PSMTs' pedagogical identity concerned with technology use. The author showed that PSMTs develop their identities by “negotiating changing relationships between their teaching environments, their actions, and their beliefs” (p. 54). Thus, this study highlighted that PSMTs are active agents that re-interpret the social conditions of the practicum environment in the light of their own professional goals and beliefs.

Goos and Bennison (2008) focused on the notion of communal identity as they investigated the PSMTs' sense of connectedness and belonging in relation to an online community of practice (CoP). Two successive cohorts of PSMTs enrolled in a mathematics curriculum course participated in this CoP, which included the PSMTs sending, reading, and answering messages on a bulletin board. The authors found that the CoP's joint enterprise of becoming a mathematics teacher was

defined differently as the PSMTs moved between the university and professional contexts. In the university context, the negotiated enterprise was related to the practice of being a university student. In the professional context (which includes practicum) the enterprise was related to the practice of teaching in the school.

Van Putten et al. (2014) also addressed the relationships between PSMTs' identities and the teaching practicum, but in a different light. These authors investigated the professional mathematics teacher identity in terms of the relationships between the PSMTs' self-perceived identity and the PSMTs' actualized identity in the classroom during practicum. The authors considered that PSMTs develop their professional mathematics teacher identity from their perceptions of themselves as mathematics specialists, as teaching-and-learning specialists, and as caring specialists. The main result of this study was the existence of incongruences between PSMTs' perceptions of their identity and the actualization of that identity in the classroom, particularly in terms of their perceptions as teaching-and-learning specialists and as caring specialists.

The fourth article, written by Teixeira and Cyrino (2015), is focused on the role that the planning stage plays in the development of some aspects of PSMTs' professional identities before the teaching practicum. The authors investigated the interactions between PSMTs and their university supervisors during planning meetings. Teixeira and Cyrino (2015) concluded that the interactions promoted by university supervisors who held a "questioning attitude" led to the development of several elements related to the PSMTs' professional identities, such as the awakening of a critical sense in planning lessons, the development of an inquiry attitude, and the ability to reflect on the lesson plans before teaching the lessons.

### ***3.2 PSMTs' Identities and the Learning of Specifics Mathematical Topics***

Three of the four studies that constituted this group investigated the relationships between the development of PSMTs' identities and the learning of specific mathematical topics during pre-service education. In the fourth study the researchers sought to develop a theoretical framework for investigating a particularly situated identity of mathematics teachers: their identity as embedders-of-numeracy.

Gonçalves Costa and Pamplona (2011) analyzed the opportunities that pre-service education offers to PSMTs for developing their identities as statistical educators. Drawing on a situated learning perspective, the authors used the notion of participation in CoPs for describing and analyzing the curricular transformation of a mathematics education degree program. This study highlighted that in order for PSMTs to assume identities as statistical educators, it is necessary to introduce modifications in the curriculum of mathematics education degree programs including courses that cross boundaries between mathematical, statistical, pedagogical, and professional practices.

Ticknor (2012) also made use of the notion of participation in CoPs and combined it with the person-in-practice-in-person (Lerman 2001) unit of analysis. With these analytical tools Ticknor (2012) explored how PSMTs' mathematical identities were influenced by their participation in a CoP developed inside an abstract algebra course. Ticknor (2012) claimed that observing the instructor's teaching style had an impact on the PSMTs' identities, which might have influenced the PSMTs' pedagogical approaches.

Drawing on Badiou's and Lacan's theories, Brown et al. (2013) sought to analyze how PSMTs "variously identify with particular conceptions of mathematics and how those identifications support teacher education ambitions" (p. 56). The authors analyzed a set of episodes, which occurred during sessions with PSMTs devoted to the apprehension of mathematical objects through exercises centered on the PSMTs' own bodily movements. The authors showed that the PSMTs' narratives of their process of emerging understanding documented human subjects and mathematical objects coming into being. In this way, "in becoming teachers they are participating in the becoming of mathematics" (p. 571).

Bennison's (2015) article also addressed professional identity development, but in relation to the notion of numeracy. The author constructed a theoretical framework looking at characteristics of identity that seemed particularly relevant for the "context of teachers promoting growth in the numeracy capabilities of students through the subjects they teach" (p. 9). Reviewing the literature, Bennison (2015) proposed a theoretical framework built around five domains of influence: the knowledge domain, the affective domain, the social domain, the life story domain, and the context domain. Although the development of this theoretical framework was not focused solely on PSMTs, the study was included in the survey because several research questions related to PSMTs' identities as embedders of numeracy can be addressed with the framework.

### ***3.3 PSMTs Representing Their Professional Identity***

Two articles investigated the ways in which PSMTs represented their professional identity. The first one addressed the issue by analyzing written PSMTs' fictional accounts of mathematics classrooms (Lloyd 2006), and the second one examined the issue by investigating how PSMTs use, and are used, by the dominant discourses of a mathematics enhancement course (Houssain et al. 2013).

Lloyd (2006) studied professional identity in terms of how it is represented by PSMTs' written fictional accounts of mathematics classrooms. The study results showed that the PSMTs' emerging identities represented in their fictional accounts altered the traditional classroom roles for students and teachers. Thus, PSMTs' stories represented inquiry-oriented classrooms where the teacher sets up the content and structure of mathematics activities for students to investigate and discuss. Once the students began to work on these activities, the teacher's role became less

apparent. Lloyd's (2006) study underlined that defining the role of the teacher in an inquiry-oriented classroom is an issue that remains open for many—particularly for PSMTs.

Hossain et al. (2013) explored the notion of PSMTs' professional identity through a poststructuralist lens. They focused on a Mathematics Enhancement Course developed in order to prepare non-mathematics graduates to train as secondary mathematics teachers. In this study, the authors sought to explore the identity work (Mendick 2006) of PSMTs analyzing how they use, and are used, by the discourses promoted within the course for positioning themselves as future mathematics teachers. The authors focused particularly on the discourse stating that "understanding mathematics in depth" is a necessary foundation for teaching the subject. In analyzing the contrasting experiences of two PSMTs, the authors showed that some PSMTs found it easier to take up the dominant discourse of "understanding mathematics in depth" for constructing themselves as mathematics teachers. But others resisted or distanced themselves of such discourse based on their cultural identities and backgrounds. This study highlighted the need to consider the various identities that PSMTs have prior to their participation in pre-service education and how these identities interact with the discourses promoted by pre-service education.

## 4 Discussion

The studies selected for this survey investigated different moments and opportunities that pre-service education offers to PSMTs for developing their professional identity. The notion of professional identity has been used as a theoretical lens for researching field experiences, technology use, the learning of mathematical topics, the curricular design of pre-service degree programs, the participation in communities, and the discourses promoted within pre-service courses. These varied research foci give rise to different conceptualizations of PSMTs identities; thus, the studies made use of varied theoretical terms such as "mathematical identity", "professional identity", "communal identity", or "identity work". Some articles also articulate the notion of subjectivity with the notion of identity (Brown et al. 2013; Hossain et al. 2013). These studies highlight the richness and the complexity of researching the identity development of PSMTs and underline the vital importance of researchers explaining how they read, understood, and operationalize professional identity in their works (Lerman 2012).

Regarding the theoretical perspectives underpinning the selected studies, the socio-cultural approaches were frequently used—they were used explicitly in four of the ten articles. However, it is important to acknowledge the emergence of post-structural and contemporary approaches for investigating the development of PSMTs' professional identities. We believe that those approaches can enable researchers to pose new questions regarding professional identities, illuminating new facets of the research problem.

Methodologically, the selected studies shared several features. With the exception of the theoretical paper of Bennison (2015) and the study of Gonçalves Costa and Pamplona (2011) centered in curriculum analysis, the rest of the studies were small-scale in-depth and qualitative. Thus, many of studies were case studies that varied in a number of one to ten PSMTs. This is consistent with the results of the survey on research methods used in mathematics teacher education carried out by Gellert et al. (2013) who found that small scale qualitative research predominates in the area. The data sources of the studies are varied: PSMTs' writings, semi-structured interviews, classroom observations, questionnaires, teachers' reflective writings, classroom audio-tapes and video recordings. The data collected were analyzed looking for emerging themes, using mainly an interpretative analysis. Lloyd's (2006) articles differed in this matter, since she developed a narrative analysis of the data. The selected studies differed in the way and the extent to which they explained the methods and techniques used for analyzing the data.

The results and findings of the studies were diverse and similar in nature. Most of them highlighted the importance of field experiences—mainly teaching practicum—during pre-service education as key settings for the development of PSMTs' professional identities. In resonance with other research results (Bergsten et al. 2009; Goos et al. 2009; Lin and Ponte 2009), the studies of Goos (2005), Goos and Bennison (2008), Van Putten et al. (2014), and Teixeira and Cyrino (2015) underline the teaching practicum as an experience where PSMTs enact their identities as mathematics teachers, navigating and negotiating between the constraints and affordances coming from the school and the university culture. Another finding shared by some of the studies (Bennison 2015; Brown et al. 2013; Gonçalves Costa and Pamplona 2011; Ticknor 2012), is that content courses are opportunities for PSMTs to develop self-understanding as mathematics apprentices. A particularly important issue emerging from the selected studies is that many of them explored the linkages between the PSMTs' identities as mathematics learners and PSMTs' professional future as teachers that will teach these topics to secondary students. Additionally, Lloyd's (2006) study highlighted the potential of narrative writing for expressing the ways in which PSMTs see themselves and for reflecting about their beliefs, values, and experiences. Finally, Hossain et al. (2013) drew attention to the discourses promoted within pre-service education, analyzing what they make possible for PSMTs to be and what they render impossible. Hossain et al.'s (2013) study enables us to reflect on our role as mathematics teacher educators in ensuring that all PSMTs have equitable access to becoming successful mathematics teachers.

## 5 Final Remarks

The studies selected for this survey suggest that investigating PSMTs professional identity development is an emergent topic in mathematics education research. They also pose some open questions that could be considered in upcoming research: the

role of narrative writing as well as the roles of school teachers and university supervisors in the development of PSMTs professional identities; the linkages between identity development and agency development during teaching practicum; and the relationship between PSMTs' content knowledge and pedagogical content knowledge learned during pre-service education and the development of their professional identity.

This survey suggests several challenges in developing the professional identity of prospective teachers during pre-service education. Pre-service teacher education programs should offer time and space for PSMTs to reflect and discuss their knowledge and beliefs, as well as their views and expectations about becoming a mathematics teacher. In addition, pre-service teacher education programs should promote opportunities in which PSMTs reflect upon and interpret the social requisites and norms of their future teaching practices, as well as for acting upon different contexts in which these practices and discourses operate. This will help PSMT develop a sense of agency as they position themselves and gain autonomy "by taking into account their perspectives, knowledge and potentials" (Oliveira and Cyrino 2011, p. 114). It will also assist PSMTs in becoming aware of their political commitment as prospective educators and will contribute in forming responsible, autonomous and ethically demanding professionals, capable of effectively reflecting on their future pedagogical practice.

PSMTs' professional identities are rich and complex because they are produced in a rich and complex set of practices and discourses (Sachs 2005). Therefore, investigating PSMTs' identity development is a difficult enterprise. Nevertheless, this is an important enterprise because understanding PSMTs identities provides insights into why they make particular decisions (inside and outside the classroom) and into how mathematics teacher educators may assist them in developing their autonomy and agency.

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